Vacuum and Infrared-Blocking Windows for Cryogenic X-ray Spectrometers

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The official link for this solicitation is: http:--science.doe.gov-grants-pdf-SC_FOA_0000969.pdf

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Description:
Cryogenic X-ray spectrometers, such as transition-edge-sensor (TES) microcalorimeters, are of growing importance at synchrotron light sources. This class of detector combines the efficient X-ray collection of a silicon-drift detector with energy resolution approaching that of a crystal- or grating-based spectrometer. Important applications are X-ray emission spectroscopy, partial-fluorescence-yield NEXAFS, and energy-resolved scattering-momentum experiments. Emerging cryogenic detector technologies include TESs as well as microwave kinetic-inductance detectors (MKIDs), magnetic calorimeters (mag-cals), and superconducting tunnel junctions (STJs). These technologies share the common architecture of a pixelated active area that must be held at extreme cryogenic temperatures (~0.050.3 K). In the case of TESs, expansion to kilopixel-scale arrays with total active areas of hundreds of mm^2 is a near-term goal. Because the cryogenic-sensing elements must be able to observe ambient-temperature samples, X-ray-transmitting windows are a critical enabling technology. Here we solicit development of a type of X-ray windows that has high transmission in the soft-X-ray band of 2501000 eV (K lines of organics and L lines of transition metals): vacuum interfaces. Present, commercially available, high-transmission vacuum windows are made from Beryllium or grid-backed polymers. Those that will support an atmosphere with good transmission down to 250 eV are limited to a diameter of about 10mm. We seek designs with larger active areas. A possibility is a planar window array that could contain multiple, gridded active areas separated by thin support struts we envision that each sub-window might have an open area of 2550 mm^2 and the sub-windows might be separated by supports that are several mm wide-thick. Other ideas are

encouraged. The awardee would be expected to develop window designs in coordination with developers of cryogenic sensors (such as ANL or NIST) so that the active areas of the windows and the detector arrays can be matched. Window designs that will support ~0.1 atmosphere (in either direction) with much larger active areas are also sought. Improved vacuum-interface windows would also be applicable to conventional, semiconducting x-ray sensors.